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ABSTRACT

One of a series of social studies units designed to develop the reading and writing skills of low achievers, this student activity book focuses on the theme of energy. The unit can be used for high school classes, individual study in alternative and continuing high schools, and adult education classes. Separate sections cover early sources of energy, present-day sources of energy, energy waste in the United States, energy and the environment, conservation, and future sources of energy. Each section consists of a reading stressing vocabulary development and recognition of sounds. Additional sections contain definitions of the more important energy words, cartoons illustrating energy supply and demand in the United States, and an energy I.Q. test. Readings in the appendix illustrate the problems of pollution, nuclear energy, and the incident at Three Mile Island. Reading comprehension exercises are included. (LP)

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ENERGY THEME

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SO 015494

Dennis J. Garrahy
Vista Unified School District

EARLY SOURCES OF ENERGY

A. Sounds Introduced
   1. key - ey
   2. little - le

B. Vocabulary

1.	prime	9.	tremendous
2.	serious	10.	pyramids
3.	particular	11.	experiment
4.	predict	12.	generated
5.	situation	13.	correct
6.	estimate	14.	locomotives
7.	nourished	15.	generators
8.	consumed	16.	combustion

The "energy" issue has been a prime area of attention in recent years. The long gasoline lines that you have faced bring to mind that we do have some problems in the area of energy. The big question is how serious is our energy crisis? Some articles claim that the world and the United States in particular, are in big trouble. They predict that Americans are going to have to make radical changes in their lifestyles or else we will run out of energy. Other writers see energy experts as panicking. These people feel that the world will always have enough fuel. So what is the real situation? Why has the "energy issue" become such a big deal in recent years?

In the first place, man has increased his use of energy by 30 times in just the last 100 years. It would be hard to estimate what kind of increase has taken place since man first set foot on this earth.

However, we do know that man has been using energy since he arrived on this planet. The earliest form of energy was food. Plants had been nourished with the energy from the sun and then man and the animals he hunted consumed them. The earth's population was so small then that there were no real demands for energy.

Later man discovered fire and finally learned how to create fire. The next step came a little later and its was to train animals to work for him. For hundreds of years, these two sources of energy took care of man's needs.

Eventually, as the energy demands grew, man began to harness his fellow man in the form of slavery. Most of us have heard stories of the tremendous amount of work slaves have done, such as building the Egyptian pyramids. The slaves were using up energy too in their consumption of food and the demands for energy increased. Since men were now growing their own food instead of wandering from place to place, they also had more time to think and experiment with ideas. Once man settled down, he became more and more creative in finding new sources of energy. For instance, the wind was used to push windmills and also power sailboats. Water was used to turn huge water wheels.

However, the key breakthrough came with the beginning of the Industrial Revolution and age of machines. We now had developed machines that generated energy. Factories could be built away from rivers and double their production. Man no longer was dependent on natural sources of energy.

Can you think of some of the early machines that created energy? If one of your answers was steam engines, you are correct. The steam engine was used in both factories and also for transportation in steamships and locomotives. Steam also ran generators which in turn provided electricity. These early steam engines were using coal as a source of fuel.

Another machine that was invented was the internal-combustion engine (similar to our auto engines). Up to this time, petroleum products were not really in demand. Kerosene was used for heating but gasoline was considered a waste product which was thrown away! Today the internal combustion engine moves the people of the world from place to place in the form of buses, cars, airplanes and trucks. It is hard to imagine the world without gasoline! But it was less than 100 years ago that a use was found for it. Petroleum has become crucial for mankind.

PRESENT DAY SOURCES OF ENERGY

A. Sounds Introduced
   1. suits - ui
   2. prosecute - ute
   3. wrong - wr

B. Vocabulary
   1. relied
   2. comparison
   3. consequently
   4. prosecute
   5. oriented
   6. depend
   7. import
   8. reserves
   9. furnace
   10. projected
   11. trillion
   12. cubic

Our sources and consumption of energy have come a long ways in a relatively short period of time. At the present, we obtain energy from the following sources: running water, fossil fuels (petroleum and coal) and nuclear fission. As everyone reads and hears about, we are running out of fossil fuels. We have relied very heavily on them and have also been wasteful.

Just how wasteful have the world and the United States, in particular, been with their energy sources? For a start, our energy demands in the United States today are 30 times the energy we used 100 years ago. Our population has increased by only seven times. Consequently, today we are using about four times more energy than our great grandparents. In comparison with other countries in the world, a United States citizen uses twice as much as a person in Great Britain, three times as much as the average French citizen, and from 10 to 100 times the amount of someone in the third world.

We have only six percent of the world's population, yet we consume about one-third of the world's energy! This last statement is not wrong. All you have to do is look around your house. Americans are a machine-oriented culture. It suits us fine to have everything from electric toothbrushes and face cleaners to trash compactors which save trips to the garbage can. Each day, the average American uses the energy from 13.6 pounds of coal, 3.3 gallons of oil, 297 cubic feet of natural gas, 3.7 kilowatt hours of hydroelectric power, and .7 kilowatt hours of nuclear power. A child born today will use during his lifetime, 175 tons of coal, 2000 barrels (42 gallons to a barrel) of oil and 7.5 million cubic feet of natural gas!

The big question is can we continue to meet these energy needs. As can be seen, Americans depend heavily today on oil and natural gas. These fuels supply more than 75 percent of our needs. Unfortunately, the United States cannot produce that much fuel, so we import it from other parts of the world. We cannot really prosecute people who use too much energy. In 1973, we imported about 35 percent of our petroleum. By 1979 we were importing almost 50 percent of our petroleum. Can you figure out why this is a risky situation for the United States? What would happen to us if one of the countries we imported oil from went to war or just plain refused to sell us any more petroleum. The wheels of machinery in the United States would come to a grinding halt.

On the positive side, the United States does have large supplies of coal, but uses it for less than 18 percent of our energy. Coal resources are estimated at 3.2 trillion tons, but coal reserves (coal which can be economically recovered by our present methods) are considered to be only 390 billion tons. At our present rate of use, our coal reserves would last about 600 years.

Natural gas which fuels things like your gas stove and water heater and furnace, is being discovered at a slower rate than it is being used. We have reserves of about 192 trillion cubic feet and we are using around 18 trillion cubic feet a year.

Nuclear energy supplies about one percent of our energy demands now, but is expected to contribute much more by the end of the century. However, as you may have read, there is growing opposition to nuclear power plants. This opposition may limit their projected growth.

ENERGY WASTE IN THE UNITED STATES

A. Sounds Introduced
   1. oil - oi
   2. nation - tion
   3. caught - au

B. Vocabulary
   1. extract
   2. content
   3. destination
   4. electricity
   5. transmission
   6. converted
   7. inefficiencies
   8. techniques

It is estimated, that by the year 2000 (when you will be about 37 years old) our nation will be using three times more energy than we are now. If we are going to meet this demand and not get caught short, we are going to have to discover better ways to extract all the energy that is actually contained in fossil fuels. Presently, we are wasting one-half the energy content of fossil fuels.

Let's look at what happens to one ton (2000 lbs.) of coal as it is dug from the ground and watch its journey to the electric plant. The first step in getting coal is very wasteful. Forty-two percent of the coal never leaves the deep mines because it is either lost in the mining process or it is too difficult and expensive to get out of the ground. Another form of mining called strip mining presents less waste.

Only 20 percent of coal is lost in this process. Consequently, it can be seen that from the ton of coal that is actually in the ground, only 1140 pounds is removed from a deep mine and 1600 pounds from a strip mine; eight percent more is lost in processing the coal and an additional one percent is lost transporting it from mine to power plant. By the time it does reach the plant, only 1140 pounds from the deep mine and 1450 pounds from the strip mine remain from the starting 2000 pounds.

When the coal is burned, some 62 percent of the energy in the coal that actually reached the plant is lost. To put it more simply, the power plant can make good use of only 38 percent of the energy in the coal. So now our 2000 pounds of coal has yielded only the energy equal to 400 to 500 pounds of coal. The coal still has not reached its destination as electricity. As it travels through transmission lines another ten percent of energy is lost. The bottom line is that the equivalent of only fifty pounds of coal energy is actually converted to useful work from the original 2000 pounds in the ground - less than three percent!

The waste of potential energy that occurs with coal also happens with other fuels. There are inefficiencies all along the line with oil, natural gas, or nuclear fuel. It would appear that we are definitely going to have to perfect our techniques to get the most "energy" possible out of our fuels.

UNIT 4

ENERGY USE AND ITS EFFECT ON OUR ENVIRONMENT

A. Sounds Introduced
   1. graph - ph
   2. error - err
   3. weigh - eigh
   4. believe - eve

B. Vocabulary
   1. impact
   2 environment
   3. pollutants
   4. cast
   5. indirectly
   6. emission
   7. affect
   8. atmosphere
   9. radioactive

In any discussion of the energy issue, one must always weigh the impact of energy use on our environment: What happens to our environment whenever we flip a light on or start a car? In one way or another, it may disrupt the land, create solid waste, and pollute the air or water. Each year millions of tons of pollutants are cast into the air as a result of using energy.

What do you think is the biggest energy pollutant in the United States today? The automobile wins hands down. It not only directly affects the air, but also is indirectly responsible for things like oil spills, and land disruption from oil wells and pipelines. The cleanest large-scale producer of energy that we have is found in a hydroelectric plant. Even so, it may be an error to use this source of energy since thousands of acres are flooded when water backs up from the dam.

In terms of environmental pollution, let's look at a coal-fired electric plant again. Remember, there are two types of mining techniques, deep mining and strip mining. A deep mine requires about 9,000 acres to produce enough coal to keep the plant operating. A strip mine requires 14,000 acres. More land is used up for the road or tracks that bring the coal to the plant itself. Roughly, a coal-fired plant uses up 30,000 acres or fifty square miles.

You may believe that we are using up a lot of land for one coal-fired plant. But this is not the most critical environmental consequence. It is, instead, air pollution. Without emission controls, a 1,000 megawatt plant produces more than 350,000 tons of pollutants each year! 100,000 tons of these pollutants are toxic sulfur dioxide, carbon monoxide and nitrogen oxide. It is possible, through emission control devices, to reduce these pollutants to less than 50,000 tons annually. However, more than 900,000 tons of solid waste are created as a result of these controls and it takes fifteen acres a year to dispose of it.

Oil-fired power plants do not pollute the air as much as coal-fired plants and require less than two-thirds of the land area of a coal-fired system. Natural gas-fired power plants are the cleanest source of fossil fuel energy. However, as we have seen, we are using natural gas faster than we can produce it.

Nuclear power plants do little to affect the atmosphere. But their biggest environmental problems are radioactive solid wastes and the discharge of heated water into rivers, lakes and oceans. The heated water raises the temperature of the water and affects the fish and plant life cycle. By the year 2000, it is predicted that radioactive wastes from nuclear power plants in this country will amount to 500,000 cubic feet, enough to cover a city block to a depth of about ten feet.

Needless to say, our environment is being hurt by energy production and use. It is a sure fact that our population will continue to grow and energy demands will also go up. Any energy graph will point out this fact. Cures for pollution have not been totally effective and they have been costly. Your automobile now costs more and the engine does not run as well due to poor control devices. In a way, pollution controls have actually increased our demand for gasoline since the engine gets fewer miles per gallon. The control devices in the electric power plants cost the owners money and they pass the expense to the consumer in the form of higher prices for electricity.

ENERGY CONSERVATION

A. Sounds Introduced
   1. ambition - amb
   2. curious - ious
   3. question - que

B. Vocabulary
   1. encourage
   2. conserve
   3. individuals
   4. idling
   5. insulation
   6. adequate
   7. reviewing
   8. appliances
   9. devices
   10. attitude
   11. flourescent
   12. errand

So the big question becomes how can we provide the energy that our country needs yet still protect our environment? One of the first and most important steps is to encourage Americans to conserve more energy by changing some of their wasteful habits. Each one of us could do small things each day which could add up to big results. What do you think some of these small things are that would help conserve energy? Turning off lights when not in use and making only necessary trips in our cars would be a start.

If we are to have enough energy in the future, we are going to have to change some of our attitudes about transportation. For one thing, cars are going to have to be made smaller. The average American car gets twelve miles per gallon. Smaller cars could double the miles per gallon. As individuals, we could also take public transportation when possible and form car pools. When we do drive, we should not

race the engine or leave it idling for a long period of time. It would also help to keep the engine well tuned.

Another good place to save energy is in our homes. Heating and cooling are the greatest single energy users in our homes. Heating and cooling a house is like pumping air into a tire. With a fast leak, you are pumping all the time. This situation is similar to a house without the proper insulation. The greatest loss or gain of heat in most houses is through the roof. This is also the easiest area to install adequate insulation. Reviewing our tire example, you would not be required to pump very hard if you had a slow leak. In fact you could probably rest for a while at a time. This same fact would hold true for your heating and cooling systems, if you had the proper insulation.

There are many other ways to conserve energy in our homes. Can you think of some? It is predicted that turning all thermostats down two degrees in the winter and raising them two degrees in the summer could save more than half a million barrels of oil a day. We also know that household appliances use up a lot of energy. Have you ever been curious about how much gas the pilot light on your stove uses? It consumes ten percent of the gas used in the entire country. A big energy savings could be made by replacing the pilot light with ignition devices.

We could be ambitious and also save energy in our houses by using cold water in our washing machine, turning down the thermostat on our water heater, using flourescent lamps instead of regular light bulbs, and of course, turning off lights when not in use. Don't be fuelish!

The key thing about energy conservation is attitude. It may not seem like much to turn off a light here and there or cancel a short errand in your car, but if everyone pitches in, it will make a huge difference. By now, we should have a pretty good picture of the energy situation.

UNIT 6

CAN WE FILL THE "ENERGY BARREL"?

A. Sounds Introduced
   1. love - ove

B. Vocabulary

1. projecting	4. commercial	7. require
2. industrial	5. exploration	8. scrapped
3. residential	6. resources	9. gadgets

Just what will it take to keep our "energy barrel" full? We know that Americans will continue to love their energy using little gadgets. Projecting energy demand, according to our current energy use, we will use about sixty million barrels per day in 1985 and ninety-five million in the year 2000. We have already discussed several ways to reduce the projected need. If we double the miles per gallon for all passenger cars we could save five million barrels per day. If we made a ten to fifteen percent improvement in the efficiency of industrial energy consumption, we would save about four million barrels a day. Improving building designs of residential and commercial sections could save another two million barrels per day. All of these energy conservation techniques, if followed, could save about eleven million barrels per day. So now the energy barrel in the year 2000 will be around eighty-four million barrels. Can we fill it?

We could import safely fifteen percent or twelve million barrels per day. We could try to produce twelve million barrels per day from fossil fuels. However, this would require a lot of exploration and development through off-shore

drilling on the Atlantic and Pacific coasts and the Gulf of Mexico. It might also be possible to obtain about three million barrels per day from shale. This would mean using a big share of the producing areas water resources, and water is needed for agricultural and city needs.

The Alaska pipeline could supply an additional five million barrels per day. Natural gas production could supply another seven million barrels per day but this would require tripling the amourt taken from strip mining and getting a fifty percent increase from underground mining. We have already read that strip mining requires a lot of land. Taken together, coal and oil shale production at these levels would require the surface mining of over 100,000 acres each year!

As you can see, if we added up all the barrels we scraped together, we would have fifty-six million barrels per day. So what happens now? Where do we find the other twenty-eight million barrels per day for the year 2000?

UNIT 7

NEW SOURCES OF ENERGY FOR THE FUTURE

A. Sounds Introduced
   1. fair - air

B. Vocabulary

1. hydroelectric	9. hazard
2. scenic	10. disposal
3. harness	11. doubtful
4. emissions	12. clutter
5. satellites	13. speculated
6. drawbacks	14. designed
7. security	15. thermal
8. conventional	16. ethic

Our only hope is to develop new sources of energy. Even if there were enough fossil fuels, it is unlikely that our environment could absorb the ever increasing amounts of pollution their burning would create. It is already very difficult to breathe in some of our cities. Hopefully, our new sources of energy will not pollute the environment.

The question still remains, can we find the twenty-eight million barrels per day that we still need for the year 2000? We could double our production at hydroelectric plants to one million barrels per day. But in doing so, we would have to double the number of dams we have now and it will affect areas of great natural and scenic beauty.

Another three million barrels per day could potentially come from two new sources - the sun and the earth. Solar and geothermal power could supply electrical power equal to more than two hundred "Hoover Dams". There is only one geothermal plant in the United States, even though geothermal energy furnishes a major part of Iceland's power, and is used in Italy, New Zealand, Japan, Mexico, and the Soviet Union. The principle is simple: harness the energy from the interior of the earth either as steam or hot water or from heated rocks deep in the earth. The West has a number of potential geothermal plants. Care must be used, however, since a large geothermal plant could release more sulfur emissions into the air than a coal-fired plant of the same size.

Solar energy is one of the most promising sources of energy for the future. It has been used by man for centuries but not on a large scale or efficient manner. There is talk of using anything from giant desert solar farms to satellites orbiting the earth sending the sun's energy back to receiving stations. It is fair to say that we are beginning to use solar energy in the United States for water heating and space heating. California and Florida are leading the way in this field. Can you figure out why? Other countries in the world that widely use solar energy for water heating and space heating are Japan, Israel, and Australia.

Going back to our energy barrel, we still have twenty-four million barrels per day to go if we expect to fill it! Some experts claim that nuclear power is the only source able to fill this gap. However, there are several drawbacks. First, there are the potential damages to the human and natural environment and the risk to national security. Secondly, by the end of 1973, we were only producing 175,000 barrels of energy per day from the thirty-nine existing nuclear power plants.

The largest operating plant had a 1,000 megawatt capacity. Filling our year 2000 energy barrel with nuclear power would mean completing the equivalent of a 1,000 megawatt plant, at a cost of half a billion dollars in today's money, every ten days from now through the turn of the century. Can we do it?

Nuclear power seems to be the big hope for the future. One of the biggest developments in the nuclear plants is the breeder reactor which produces more nuclear fuel than it consumes. Conventional reactors use uranium for fuel but less than one percent of this fuel can be used in the controlled nuclear reactor that produces the heat needed to generate electricity. A breeder reactor, though, can convert up to 90 percent of the unusable uranium to plutonium, an element that can be used to fuel other reactors.

As you have read in newspapers and magazines, there is a major safety consideration in nuclear power. There is no chance of a nuclear power plant exploding like a bomb, but the leakage of low-level radioactivity is a hazard. The transportation, storage, and disposal of radioactive materials is a great responsibility for mankind. We have to protect ourselves and the future generations from the effects of radiation.

Other sources of energy that make no dent at all in the energy barrel today but could help out in the future are the winds and oceans. Using windmills is being considered again. There are only certain places where they would be effective, such as the Great Plains and along the coasts. It is usually breezy in these areas. However, it is doubtful if the wind could produce much large scale power, and the big steel towers would clutter the landscape.

It has been speculated that we could gain energy from the oceans through tidal power where there is a big difference between high and low tide. There is only one commercial tidal electric plant in the world and it is located on the coast of France. At the present time, none of the plants on the drawing board for the United States have proved practical. There is also talk of taking advantage of energy from the ocean through temperature differences between the surface of the ocean and the deeper water. Heat engines are being designed to operate across these thermal lines. This idea might have some potential.

Needless to say, there is no cure all for the world's energy needs. Men and women around the world are going to have to understand the connection between energy conservation and energy production. We are going to have to maintain a world energy conservation ethic if we are going to keep the energy barrel full. If we don't make some changes soon, the "spaceship earth" may be heading for a crash landing.

UNIT 8

ENERGY VOCABULARY WORDS

Barrel	Crude oil is measured in a unit called the barrel. It is equal to 42 U.S. gallons. One barrel of crude oil has about the same energy as 350 pounds of coal.
Coal	A solid fuel made from the fossils of plants living hundreds of millions of years ago.
Crude Oil	A liquid fuel made from the fossils of animals and plants at the botton of age old seas.
Direct Energy Conversion	The process of changing any other form of energy into electricity without machinery that has moving parts. An example would be a battery that changes chemical energy into electricity by direct energy conversion.

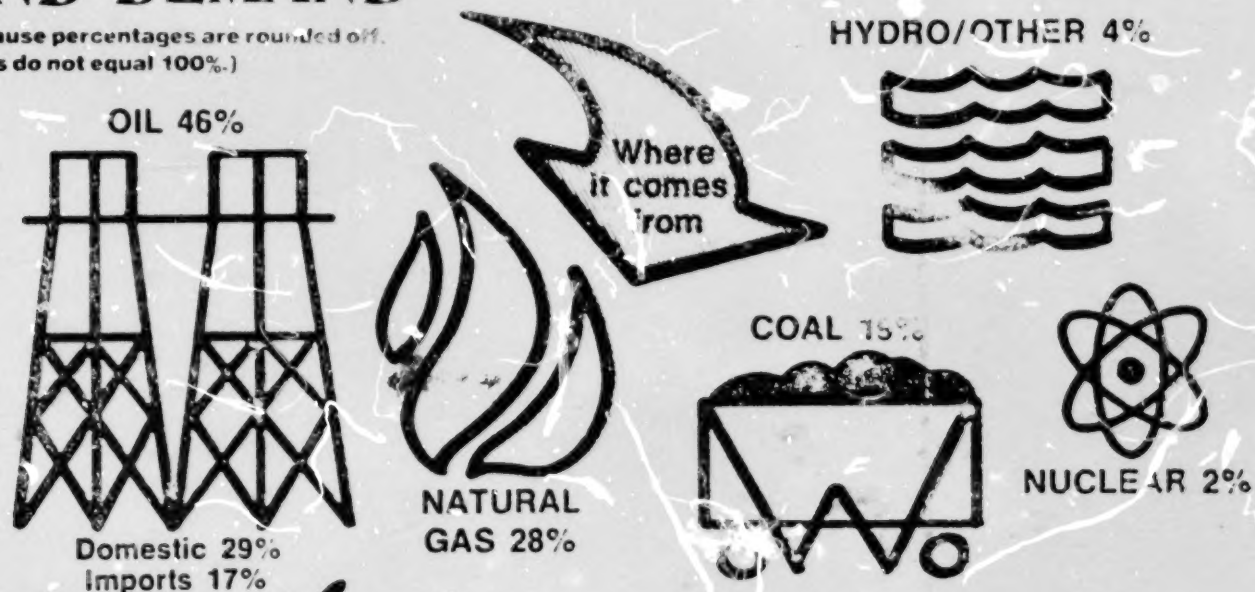
Energy	The ability to do work or make things work.
Fossil Fuels	The splitting of one atom into two or more smaller atoms. This process of fission often releases large amounts of energy.
Fuel	Anything that can be burned or fissioned to produce heat energy.
Geothermal Energy	Heat energy produced deep within the earth largely by radioactive materials that occur there naturally.
Natural Gas	Gas fuel formed from the fossils of ancient plants and animals. It is often found with crude oil.
Nuclear Power	Energy produced by splitting atom (such as uranium) in a nuclear reactor.

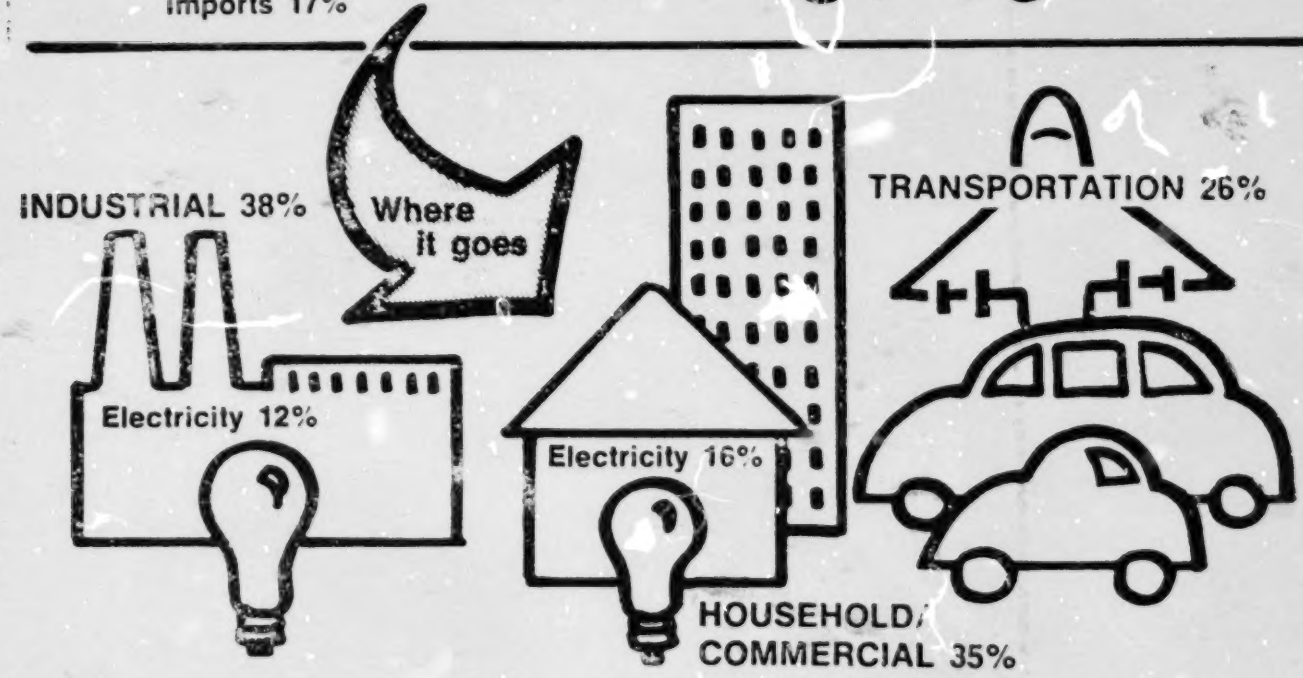
Energy Vocabulary Words

Solar Energy	The energy obtained from the sun.
Solar Power	Electricity, heat, or other useful energy produced from sunshine.

UNITED STATES ENERGY SUPPLY AND DEMAND

(Because percentages are rounded off, totals do not equal 100%.)



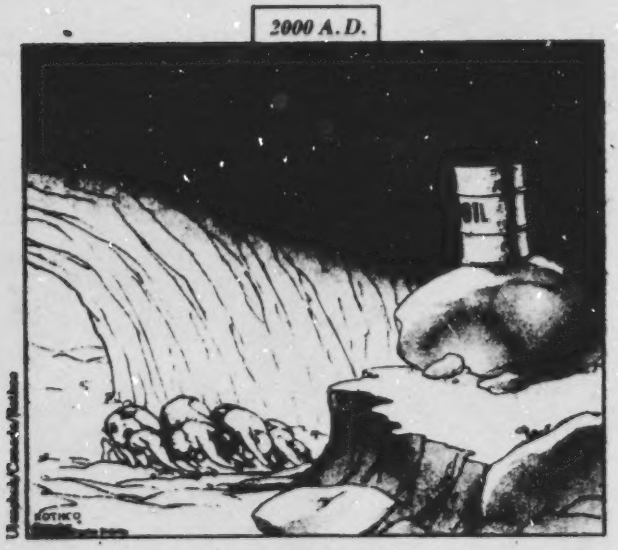


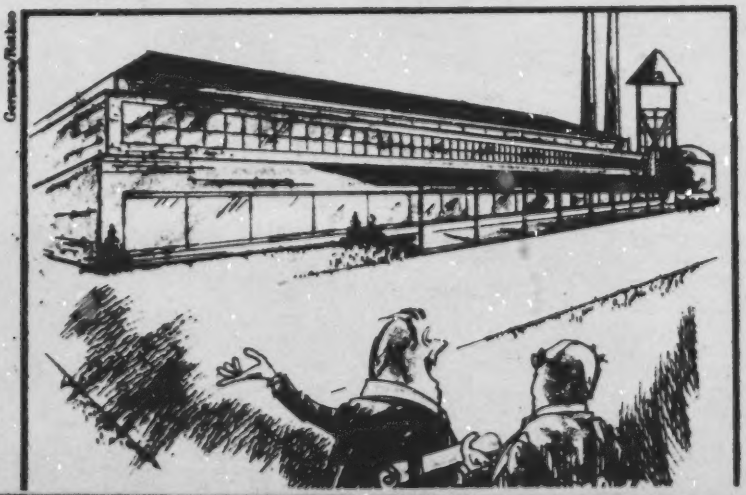
1. What source of energy does the U.S. most rely on?
2. If all nuclear plants were shut down, how much of its energy supply would the U.S. lose?
3. How much of the total U.S. energy supply is used to make electricity?

In a great national debate, cartoonists kid all sides.

4 WAYS TO SMILE AT OUR ENERGY PROBLEMS

POLITICAL CARTOONISTS have views on everything—including our energy problems and what to do about them. They also have opinions about the causes of some of the problems. As you look at these cartoons, answer the following questions for each: 1. Whose view of the energy crisis is the cartoonist expressing? The view of consumers? Energy suppliers? Environmentalists? Everybody? Someone else? Explain your answers. 2. Do you agree with the cartoonist's view? Why or why not? 3. In your view, is the cartoon truthful? 4. What kind of cartoon would you draw to express the same or an opposing idea?





"Yes, we've complied with all state, federal, and environmental regulations. Now we're going out of business."

BEST COPY AVAILABLE

TEST YOUR ENERGY I.Q.

1. How much of the energy used in gas stoves supplies the pilot lights?

   a) 10%
   B) 25%
   c) 50%

2. An incandescent lamp and flourescent lamps having the same light output.

   Which energy uses more efficiently?

   a) flourescent
   b) incandescent
   c) both about the same efficiently

3. How many soft drink cans can be manufactured from recycled aluminum with the energy needed to make a single can from aluminum ore?

   a) three
   b) five
   c) twenty

4. How long would a 100 watt light bulb burn on the energy needed to manufacture one throw-away soft drink can or bottle?

   a) 10 minutes
   b) 5 hours
   c) 20 hours

5. How much of the energy stored in crude petroleum is lost between the oil well and a moving car?

   a) 20%
   b) 60%
   c) 90%

6. The heat energy of a gallon of gasoline is equivalent to:

   a) 5 man-days of labor
   b) 15 man-days of labor
   c) 25 man-days of labor

7. How much faster than their rate of production are we consuming our fossil fuels?

   a) 10 times
   b) 1,000 times
   c) 1,000,000 times

8. What fraction of the world's energy consumption occurs in the United States?

   a) over 10%
   b) over 20%
   c) over 30%

9. Which of the following fuel resources is in greatest danger of exhaustion?

   a) coal
   b) petroleum
   c) natural gas

10. In the year 2000, American total energy demand will be:

    a) the same as today
    b) twice as much as today
    c) three times as much as today

11. In 1976, U.S. energy consumption

    a) Went down nearly 5%
    b) Went down 2%
    c) Stayed the same
    d) Went up nearly 5%

12. Most homes in America are heated by:

    a) Coal
    b) Electricity
    c) Natural gas
    d) Oil

13. What is our country's most abundant energy resource?

    a) Coal
    b) Electricity
    c) Natural gas
    d) Oil

14. What percentage of the oil Americans use is imported from other countries?

    a) 10%
    b) 20%
    c) 30%
    d) Over 40%

15. The first Secretary of the newly formed Department of Energy is:

    a) Cyrus Vance
    b) James Schlesinger
    c) William Simon
    d) Bill Moyers

16. From source to end-use, what is the most efficient form of energy?

    a) Coal
    b) Electricity
    c) Natural gas
    d) Oil

17. What's the first thing you should do to save energy in your home?

    a) Insulate the attic
    b) Turn down the thermostat
    c) Install storm doors and windows
    d) Put up aluminum siding

18. Electricity is generated using:

    a) Coal
    b) Natural gas
    c) Oil
    d) Uranium
    e) All of these

19. What energy provides the largest amount of fuel for America's industry?

    a) Coal
    b) Electricity
    c) Natural gas
    d) Oil

20. What fuel supplies three times as much of our country's energy requirements as electricity does?

    a) Coal
    b) Natural gas
    c) Oil
    d) Nuclear power

21. In the years ahead, what kind of energy system is our country likely to have?

a) All-solar
b) All-electric
c) All-gas
d) None of the above

22. From an environmental standpoint, what is the cleanest energy?

a) Coal
b) Electricity
c) Natural gas
d) Oil

23. Someday we may very possibly get energy from:

a) Seaweed
b) Ocean water
c) Garbage
d) All of these
e) None of these

24. What is the cleanest way to use our country's coal?

a) Burn it directly
b) Use it to generate electricity
c) Convert it to gas
d) Convert it to oil

25. Our country's most efficient energy delivery system is the million-mile network of underground pipes that carry:

a) Coal
b) Electricity
c) Natural gas
d) Oil

26. The U.S. consumes more energy than:

a) The Soviet Union
b) Japan
c) Great Britain
d) West Germany
e) All of the above combined

ENERGY I.Q. TEST ANSWER KEY

1. C
2. A
3. C
4. B
5. C
6. B
7. C
8. C
9. C
10. B
11. D
12. C
13. A
14. D
15. B
16. C
17. B
18. E
19. C
20. B
21. D
22. C
23. D
24. C
25. C
26. E

APPENDIX READINGS

WITH QUESTIONS & EXERCISES

Appendix Reading #1 - Energy Theme
To be used in conjunction with Unit 2

Coal Plants Ignite Pollution Protests

Vocabulary

1. environmentalists
2. visibility
3. stalemate
4. controversey
5. dilemma
6. deterioration
7. pursue
8. reliability

FARMINGTON, N.M. - A group of New Mexico citizens has been trying for eight years to force a large utility to reduce pollution from its giant coal-fired power plant. The plant is located in the remote corner of their state and sends most of its power to Phoenix and Los Angeles.

At issue is whether the utility, Arizona Public Service, should "retrofit" the enormous coal plant with pollution control devices called scrubbers. The utility argues that such controls are unnecessary, too costly, and difficult to operate.

Environmentalists argue that pollution from the plant frequently reduces visibility throughout a large portion of the Southwest, including the Grand Canyon. The little-known New Mexico controversey, now in stalemate, illustrates a national energy policy maker's dilemma.

Because coal plants are dirty, the federal government recently ordered all new facilities to install strict pollution controls, including scrubbers. But hundreds of existing coal plants built before there was widespread concern to protect the enviornment, are heavy polluters.

Utilities could conceivably operate the old plants far past "retirement age" to avoid building costly scrubbers on new plants, environmentalists say.

The dilemma: should older plants be required to scrub or not to scrub? Thus, the question state and federal energy authorities are asking themselves today is are the costs worth the benefit?

The state of New Mexico, for one, feels scrubbing is worthwhile. There is growing evidence, environmentalists say, that mounting sulfur dioxide emissions are responsible for "acid rain" that is reportedly killing fish population in the U.S. and the Canadian lakes.

Haze is said to be increasing throughout the Southwest as well. And many environmental experts feel coal plants without scrubbers are a main cause of such deterioration.

Last year, New Mexico ordered Arizona Public Service - the utility that operates the 2085 megawatt Four Corners Power station - to install pollution sensors to monitor the amount of sulfur dioxide given off by the plant. After six months, results showed that the plant had not violated sulfur dioxide standards.

A group called the New Mexico Citizens for Clean Air and Water does not agree. The reason the plant did not violate sulfur dioxide standards, said the group's president, John Bartlitt, is that the utility kept the plant almost turned off during the six-month period.

Four Corners normally operates 60 percent of the year, Bartlitt said, but it ran at 27 percent capacity while the pollution sensors were on.

"This is the way Arizona Public Service chooses to operate," he said. "They are very deceitful. I would call them welchers."

Jarmen, the utility's vice president, agreed that the monitoring period was not a fair test that the plant was "more off than on."

"But we are committed to obeying the law," he said. "And the law has remedies. If you believe you are right, you pursue it. We are worried about costs and we have the obligation to our stockholders to consider economics. Our basic philosophy is no matter how big or little the investment, if there are not benefits, the money should not be spent."

Scrubbers for the plant would cost an estimated $230 million. That would add an extra five cents on a $100 utility bill in Southern California in 1983, Bartlitt said.

"In return, the people of California will be able to see the Grand Canyon and other parklands when they come to visit. I don't think that's too much to ask."

"Furthermore," Bartlitt said, "the utilities can afford the cost. Four Corners provides the second cheapest power in the system of the the six utilities, after hydroelectric power."

While scrubbers cost are a major issue in the controversey, there is another problem - scrubber reliability. One utility in the United States is leading the pack in experimenting with new scrubber design. It is Public Service of New Mexico, and, ironically, sits directly across the highway from the Four Corners plant.

A few years ago the New Mexico utility took a poll of its customers asking if they would pay extra on monthly bills to protect the air, said utility spokesman Sherry Robinson. The answer was yes, customers would pay double. As it turned out they are paying ten percent more.

In the long run, many coal plants are going to have to follow in the footsteps of Public Service of New Mexico if the U.S. is to win the battle of pollution.

COAL PLANTS IGNITE POLLUTION PROTESTS

Answer the following questions in a complete sentence.

1. What are scrubbers?

2. What is responsible for the haze that hangs over the Northeast in the summer?

3. How was the coal plant at Four Corners able to keep from violating sulfur dioxide standards when it was tested?

4. Which company is experimenting with a new scrubber design? Why are they attempting to come up with a new design?

Appendix Reading #2 - Energy Theme

To be used in conjunction with Unit #4.

Three Mile Island Incident

Vocabulary

1. mishap
2. evacuate
3. refuge

A few minutes drive from Middletown, PA., Three Mile Island is located in the Susquehanna River. There, on March 28, 1979, a nightmare almost came true. Millions of people's lives were threatened by the escape of radioactive gases.

As Governor Richard Thornburgh said, Pennsylvania overnight became "the place where the worst fear of modern man almost came to pass."

It was, of course, an accident. The cause seems to have been a three-way combination of poor design, mechanical breakdown, and human error, all of which added up to the worst nuclear accident in the nation's history.

As if the accident itself were not enough, plant workers were confused by instruments that failed to tell them what was actually happening to the fiery core. Gauges, dials, and warning lights gave false readings.

One news reporter put it this way: "The men in the control room were in a situation roughly the same as the pilot of a jumbo jetliner approaching touchdown without the landing gear lowered - and with no alarm in the cockpit to warn that the wheels were still up."

Although there were no immediate deaths or injuries, there was a release of radioactive steam into the air and radioactive water into the Susquehanna River. Following warnings about the possible health hazards, thousands of Pennsylvanians fled their homes.

Now, more than five months after the accident, the immediate danger is past. But the national debate over the safety of nuclear power may be just beginning.

Long after the Three Mile Island nuclear reactor was brought under control, demonstrations against nuclear power broke out in the United States, France, Germany, Spain, Canada, and Japan. As one observer put it, "Nuclear power is no longer something for scientists and engineers only. Now it is a social issue."

As the full story of Three Mile Island began to unfold, a lot of people began asking the questions: Can it happen again? Are other plants safe?

Two weeks after the Three Mile Island accident, the Nuclear Regulatory Commission warned of similar risks. The commission stated that 42 other nuclear plants could experience the same kinds of problems that had spread radioactivity across the Pennsylvania countryside.

It also became apparent that the problems was more than a technical one. Critics argue that because nothing like Three Mile Island had ever happened before, many people in the nuclear industry and even in the government had dedeloped an "it just can't happen" way of thinking about nuclear accidents.

Plant workers said they had not been trained to handle the kind of mishap that crippled Three Mile Island. Harold Denton, of the Nuclear Regulatory Commission, admitted that federal officials had grown "somewhat complacent" about nuclear plant safety.

Finally, say critics, because so many people thought it couldn't happen, there was little thought given to how to evacuate people if it did happen.

Near the nation's largest city, New York, government officials discovered there was almost no idea of what to do should there be an accident at the nearby Indian Point nuclear power plant.

Sometimes, where emergency plans do exist, not enough people know about them, as the citizens of Bradford, N.H. (population 1,500) learned one day. No one, it seems, had bothered to tell Mrs. Woody Best that the 12-room inn she and her husband operated was listed in the federal evacuation plans as a refuge from a nuclear attack or power plant accident.

Neither had anyone bothered to tell Champ Wright that he was expected to house 90 nuclear refugees in his unheated junk shop. "I'm not one to turn people out in the street," said Mr. Wright, "but the place is so full of junk you can't get 20 customers in there on a summer afternoon."

The thought of 90 refugees from a power plant leak standing around in an unheated junk shop does seem a bit ridiculous, but no one is laughing. And that, say boosters of nuclear power, is good.

Although it was hardly a pleasurable experience, many people believe that simply because the unthinkable almost happened at Three Mile Island, the incident may prove valuable. As a result, the future will bring better design of nuclear power plants, better training for operators, better management by power companies, better regulation from Washington, and a less carefree attitude on the part of local government officials.

Indeed, the Environmental Protection Agency (EPA) has already decreed that, starting December 1, nuclear power plants must reduce the amount of radiation outside the plant's boundaries. The reason, says the EPA, is that we simply don't know the danger of long-term exposure to low-level radiation.

The very fact that safety rules will be tightened may threaten the long-term development of nuclear energy. According to one study, even without figuring in the cost of new safety rules, the cost of building nuclear power plants may be twice as high as the cost of coal-burning power plants by the year 1989.

And, says the study, electricity produced by nuclear plants may be 50 percent more expensive than electricity from coal-fired plants.

For the present, however, most people agree that there is little alternative to using nuclear power. Although nuclear plants generate only about 12.5 percent of all electricity used in the U.S., they are pretty important in many parts of the country.

Vermont, for example, gets 79 percent of its electricity from nuclear plants. Other states that depend on nuclear power are Maine, 65 percent; Connecticuit, 53 percent; Nebraska, 50 percent; and South Carolina, 44 percent.

Shutting down nuclear plants would mean burning another 1,300,000 barrels of oil each day. And, since the widespread use of solar or other new kinds of energy is several years away, the nation's energy needs will have to be met by the energy sources we already have.

Even the White House Council on Environmental Quality, no cheerleader for nuclear power, says that the nation will need all the nuclear and coal-fired power plants that are being built.

So, in the end, the choice seems to be neither shutting down nuclear power plants nor rushing to build more and more of them. The answer lies somewhere in the middle.

Many people, whether pro or anti-nuclear power, might well agree with a sermon delivered by the Rev. Richard Deardoff, pastor of the Church of God, in Goldsboro, near the Three Mile Island plant.

Four days after radioactivity had spilled out into the air and thousands of people had fled their homes, the four parishioners who showed up for Sunday services heard the Rev. Deardoff's opinion of what was happening:

"In think God is saying, 'Be careful'."

Exercises

Answer the following questions in a complete sentence.

1. What do experts feel caused the Three Mile Island accident?

2. Why did thousands of Pennsylvanians flee their homes after the accident?

3. How many nuclear power plants do we have in the United States today?

4. Were the officials at the Three Mile power plant aware of what to do if there was an accident? Explain.

5. Why may the Three Mile Incident prove to be a valuable lesson?

6. What are the new safety rules going to do to new power plants?

Appendix Reading #3

To be used in conjunction with Unit #4

What Would Happen if San Onofre Nuclear Plant Blew Up?

Vocabulary

1. castastrophe
2. dissipated
3. turbulence
4. plume
5. nodules
6. contaminated
7. decontaminate

With memory of the near-disastrous nuclear accident at Three Mile Island still lingering, we are faced with the question of what would happen if the ultimate nuclear disaster - a reactor core meltdown - were to occur at San Onofre nuclear power plant, 16 miles north of Oceanside. This article examines the consequences of such an accident to North County residents.

SAN ONOFRE - A nuclear catastrophe at San Onofre could result in an epidemic of cancer, birth defects, and other diseases for persons up to 35 miles downwind of the nuclear power plant.

Just where the radioactivity would go depends largely on what direction the wind is blowing and for how long. Dr. Beyea's study is based on a constant wind flow in one direction.

Changing and complex wind currents would greatly add to the difficulty of predicting the path of radioactivity plume and planning for evacuations. Current emergency plans call for evacuating only three to five miles from the power plant.

California emergency officials have just begun their first study of how various worst-case accidents would affect people living and working around this state's four operating nuclear power plants. The research was ordered by state legislators following the Three Mile Island accident in March.

In the case of the North County, the wind blows from San Onofre toward Oceanside and Carlsbad six percent of the time, or slightly more than one day in 20.

Bonsall and Valley Center would have a higher chance of receiving radiation since the wind blows in that direction from San Onofre 11 percent of the time, or slightly more than two days out of 20..

Air currents are aimed towards Fallbrook eight percent of the time, but radiation levels would be somewhat dissipated by turbulence created by mountains on Camp Pendleton. Vista, San Marcos and Escondido fall between the wind quadrants that blow towards Oceanside and Bonsall.

Immediate effects include sickness and death within two months for persons caught in very high dose regions. Such a very high dose region is expected within 12 miles of the power plant.

However, very high dose regions could be created up to 30 miles downwind of the plant if heavy rain washed the radioactivity to the ground, if the accident occurred on a clear night with low wind speed and high fallout, or if turbulence were suddenly created as the invisible plume passed overhead.

In addition, Beyea concluded that "most of" the persons within 35 miles of the nuclear power plant who are under the radiated cloud as it passes overhead and who stay within the radiated area for one day, would develop thyroid nodules.

The nodules would require surgical removal and lifetime medication thereafter. (Thyroid glands would collect radioactive iodine and receive much greater doses than experienced by the rest of the body.)

Thyroid nodules would develop in virtually all exposed children and a large fraction of adults, he said. In addition, a narrow two-to-three-mile-wide area would be so highly contaminated that a "no-man's land" would be created in which people wouldn't be allowed to live or work, except for limited periods of time, for 100 years, he said.

A narrow strip of more permanent radioactivity could extend up to 200 miles from the power plant, said Frank von Hippel, a colleague of Beyea, who also works at the Princeton University Center for Energy Environmental Studies. Von Hippel obtained his information from a Nuclear Regulatory Commission study.

Beyea continued, "..residents couldn't go back to their homes for years in the absence of highly effective decontamination procedures."

Decontamination would require sandblasting a buildings' surface, replacing windows and scraping away the interior wall surfaces. "Over the years, some of the radiation would spread out still further due to wind blowing around particles which had been eroded and re-suspended," he said. "This spreading although representing a relatively small amount of released radioactivity, would be a source of continual worry for residents of other areas."

He also suggested development of more complete emergency plans and a study of how potassium iodide pills could be distributed to the population to prevent 90 to 99 percent of the projected throid nodules. (Potassium iodide blocks the absorption of radioactive iodine by a person's thyroid gland.)

Enough pills to treat a million people were flown into Harrisburg, Pennsylvania within a few days of the Three Mile Island accident - too late if a meltdown had occurred prior to the shipment's arrival.

A "China Syndrome" accident is now considered more likely since the Three Mile Island accident. Past nuclear accidents now point to the possibility of a major release of radioactivity within the next 30 years at one of the nation's 70 operating nuclear reactors, estimates Beyea.

People caught downwind in the (radioactive) plume would receive radiation doses immediately from the cloud overhead and a continuing dose from radioactivity inhaled during plume passage," said Beyea.

Exercises

WHAT WOULD HAPPEN IF THE SAN ONOFRE NUCLEAR POWER PLANT BLEW-UP?

Answer each question in a complete sentence.

1. What would determine where the radioactivity would go if there was an accident at San Onofre?

2. What kinds of things happen within two months to persons caught in very high dose regions?

3. What would be distributed to the people to prevent 90 to 99 percent of the projected thyroid nodules?

4. What two local cities would have a higher chance of receiving radiation from San Onofre?

Appendix Reading #4 - Energy Theme

To be used in conjunction with Unit #4

Haze and Acid Rain: Growing Problem Has Officials Alarmed

Vocabulary

1. yields
2. pall
3. obliterated
4. aerosol

Year after year air has grown hazier and rain more acidic throughout Midwestern and Northeastern states untill now, suddenly aware of overall effects, the federal government is alarmed.

The haze and vinegar-like rain, both caused by common combustion processes, are exacting a toll:

- Acid rain is believed to have destroyed half the fish in hundreds of lakes in the Airondack mountains of upstate New York.

- The Canadian government last month complained to American officials about dying lakes, reduced forest yields and damaged soils in Ontario province - all caused by U.S. pollution.

- Satellite cameras have captured images of a gigantic pall of thick man-made haze that stretches from the Carolinas to Canada's Maritime Provinces.

- Pilots flying over the Artic Ocean report a springtime haze so thick that any view straight down in obliterated. Evidence is strong that the haze stems from industrialized regions of Northern Europe and the United States.

- The daily maximum temperature has apparently dropped three to four degrees Fahrenheit in both Charlotte, N.C., and Lexington, KY., a fact which some researchers attribute to haze.

The haze is primarily a byproduct of coal-fired power plants, they said. When high sulfur coal is burned and pollution controls are not built into plants, as is the case with most older facilities, sulfur dioxide is produced in enormous quantities. Sulfur dioxide itself is a colorless gas. But when it encounters high humidity, it becomes what scientists call an aerosol, in this case one named sulfate.

Sulfate, one expert explained, is essentially, "a gas wanting to become a liquid." It hangs around in the atmosphere and severly limits visibility.

Sulfate has been increasing throughout Eastern and Midwestern states over the last 30 years as the number of coal-fired plants had been increased along the Ohio and Tennessee valleys, the experts said.

When there were few plants, sulfate was insignificant. But as demand for electricity soared - especially to run more air conditioners in hot, muggy climates - the sulfate problem grew.

Utilities increased the problem by putting tall stacks several hundred feet high, on power plants built from the 1960's on, these experts said.

This practice reduced pollution levels measured near the plants, leading neighbors to believe operations were clean, but created pollution problems hundreds of miles away, in other states and in Canada.

The reduction in visibility from sulfate has been slow, said John Trijonis, an air pollution research scientist with Technology Service Corp. in New Mexico.

It has built up so slowly that people don't think of it as air pollution, he said in a recent interview. Even meterologists mistakenly label it "high relative humidity" or "hydrocarbons from plants."

"People don't see any sources emitting it," Trijonis said, so they think it's normal. "But if you measure the air, about half the visibility reducing particles are sulfate."

Exercises

Haze and Acid Rain: Growing Problem Has Officials Alarmed

Answer the following questions in a complete sentence.

1. When high sulfur coal is burned, and pollution controls are not built into plants, what is produced?

2. What is sulfur dioxide?

3. What happens to sulfur dioxide when it encounters high humidity?

4. In what mountains has acid rain destroyed half the fish in hundreds of lakes?

5. What comes out of automobile exhaust and power plants?

Appendix Reading #5 - Energy Theme
To be used in conjunction with
Unit #7

Students Build Inexpensive Solar Generator

Vocabulary

1. scrounged
2. frugally
3. priority
4. mutineers
5. remoteness
6. pledged

A group of Pasadena students who set out to prove the government is "full of baloney" about the cost of solar energy has succeeded in building a solar collector and generator that produces 5 kilowatts of electricity, a feat the government says is quite respectable.

The students are planning to donate the solar device to the 65 inhabitants of Pitcairn, a remote South Pacific island where energy costs have soared in recent years.

"The fact they are producing electricity using this technology is an admirable first step," said Al Marriott of the Jet Propulsion Laboratory in Pasadena, where government research on such solar collectors is centered.

While the high school and college-aged students admit they did not nail down the costs of making electricity from sunlight, they say they "learned a lot."

"We could never build another one like it," said Mark White, 20, one foreman of project Sunfire. "We've learned stuff that you could never learn without actually going out and doing it," said another foreman, Neil Dipprey, also 20. Most of the parts were scrounged and donated.

However, the young foreman-inventors said they have plans to forge a solar future. Along with two others, they founded a company last year called the Solar Dynamo Gang, Inc.

"The company will manufacture 2-kilowatt solar generators for use in remote places or on rooftops in Los Angeles," Dipprey said. "We want to help people cut the cord to utility."

Sun Raider, as the units are called, will sell for $5,000 each. The group is now making special tools to mass-produce the device. Two kilowatts would be enough power for a single family dwelling, they said.

Sunfire, at five kilowatts, will be enough to run the refrigerators on Pitcairn, where people live frugally. The island is famous as the hideout of mutineers who tossed Captain Bligh off the H.M.S. Bounty in 1789. Descendants of mutineers and their Tahitian wives still live on the island.

Solar energy is tailor-made for remote islands such as Pitcairn, Dipprey said. The islanders were being forced to leave home because diesel fuel needed to run Pitcairn's main generator is too expensive. It costs $300 a barrel. Sunfire is a gift of love, the students said, from their generation to the past generation.

Top priority now is to finish Sunfire, Dipprey said. The project began five years ago. Frank Broyles is a backyard inventor and solar tinkerer who works at JPL but is not connected with solar projects there, was fed up with the government estimates of solar energy costs. "They said a collector would cost $70,000 to $80,000 a kilowatt," he recalled recently. "I said baloney, we can do it for less."

Broyles enlisted the help of a physics class at Cresenta Valley High School in the fall of 1974. It was just after the oil embargo, and the class wanted to demonstrate its concern for the energy crisis, he said.

About the same time, Tom Christian of Pitcairn island heard about the project via his shortwave radio. (His great-great-great-great-grandfather was Fletcher Christian, who spearheaded the mutiny on the Bounty.)

"Tom contacted us and asked if they could have it, if it worked," Broyles said. The answer was yes. "There really wasn't anything else to do with it," he added.

In summer of 1975 the Sunfire project was moved onto a back parking lot of the Jet Propulsion Laboratory. Work proceeds there now on a casual basis, meaning after 6 most evenings and on weekends.

In the five years since the project began, students from numerous schools have drifted in and out of the project. Mark White, also 20 years old and a leader of the project, estimated that from 200 to 300 students had worked on Sunfire over the last five years.

"Some lose interest," White said, "but most who leave have to go away to school." White entered a local junior college to be near the project.

Today about 22 students participate with about eight main workers, he said. Broyles likes to play down his role in the project, but students like White and Dipprey who have been with Sunfire a long time seem to love him deeply.

Sunfire is a grand structure, a steel cradle of mirrors focusing sunlight to create steam to drive a steam engine which in turn powers an electric generator.

Many of its parts once served other purposes. The bottom half of the steam engine was taken from a Honda 350 motorcycle. An old meatpacking plant and a Model T Ford were among the sources of steel for the support structure.

Soaring 30 feet high from a sturdy triangular base, Sunfire weighs about 15 tons and contains 240 mirrors especially ground by the students.

It works like this: at dawn the cradle with its mirrors is tilted toward the east, waiting for the sun. Throughout the day, it rocks slowly toward the west, tracking the sun. Sunlight is thus continually aimed at the steam engine.

A small motor automatically moves the cradle in concert with the sun's movement across the sky. At sunset, the cradle trips a lever that causes the motor to run backward, returning the cradle during the night to its east-facing tilt.

Since the sun moves in different arcs across the sky as seasons change, the whole cradle can be tipped manually to follow these motions. A few turns on a giant lever each day keeps this orientation correct.

The system has no storage batteries, Dipprey said. Electric current shuts off at sunset. "We'd like to have storage, but it's too expensive for us now. We hope a railroad company will give us some big rail car batteries."

The students are worried about getting Sunfire to isolated Pitcairn. The island is off major shipping lanes. Mail and supply boats come every nine months.

The mutineers chose the island because of its remoteness and because it was mischarted - off by 1,000 miles - on British Admiralty maps of the day. Because it was a good hideout, they went ashore and sank the Bounty in the one small bay.

The island is a tiny rock, two square miles in size, with enchanting place names - Where Freddie Fall, Big Belly, Duddies, Up Coconuts and Ah Cut.

It has high rocky cliffs. The only "port" is a 30-foot mouth in the bay beset by heavy surges. "We want to ship everything we can think of down to them," Dipprey said, "so they can maintain and operate Sunfire. They're very resourceful people."

A key problem before the youngsters is how to move Sunfire to Pitcairn. They need a large helicopter, Broyles said. It would be far too dangerous to unload without it.

The group is putting out feelers to the Navy in hope of getting support. They expect Sunfire to be finished by the end of summer.

We have a "shopping list" of things still to get, Dipprey said. These include more stainless-steel cable, a 10-horsepower diesel engine, 25,000 pounds of cement and five large cargo boxes, among other things.

The engine will be used to run the 25-foot crane the students built themselves for installing at Sunfire. It can also be used by the islanders to "hunker down" Sunfire during the 100 mph windstorms that blast Pitcairn every five years or so.

It will take from two to three months to install the solar machine. The first task will be to pour the concrete. It takes a month to dry.

"We're picking up a publicity campaign right now," Dipprey said, to attract support and donations.

The group talks to Tom Christian twice a month by radio. The islanders are full of anticipation, and gossip is going around dozens of islands over shortwave radio.

After installation, it will be back to school for the students. Dipprey and White will be majoring in mechanical engineering at different Univeristy of California campuses.

The students have pledged never to take government money for their solar activities, Broyles said. They want to develop their own markets.

Exercises

STUDENTS BUILD INEXPENSIVE SOLAR GENERATOR

Answer each question in a complete sentence.

1. What is the "SUN RAIDER"?

2. What did the government say a solar collector would cost to build?

3. What is the name of the high school that has helped to build the solar collector?

4. How many people are presently working on this project?

5. Who are the students going give their completed solar collector to? Why?

6. How many mirrors are on the "SUN FIRE"?

7. What are some things that the students still need for their solar collector?

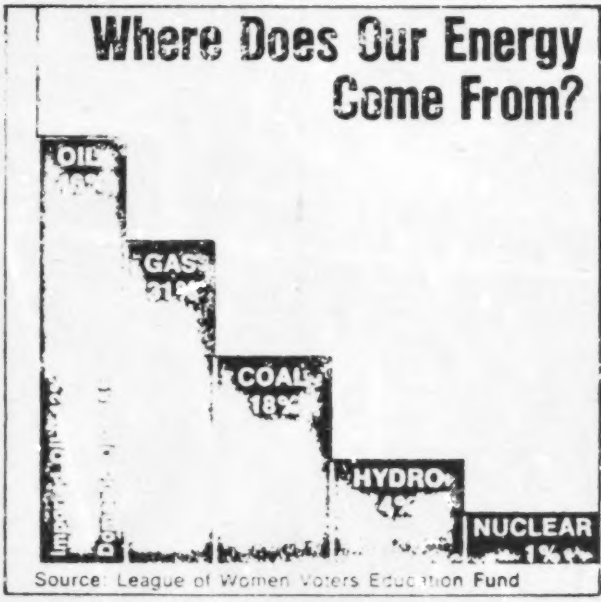
Energy Facts in Focus

Here Comes Energy...

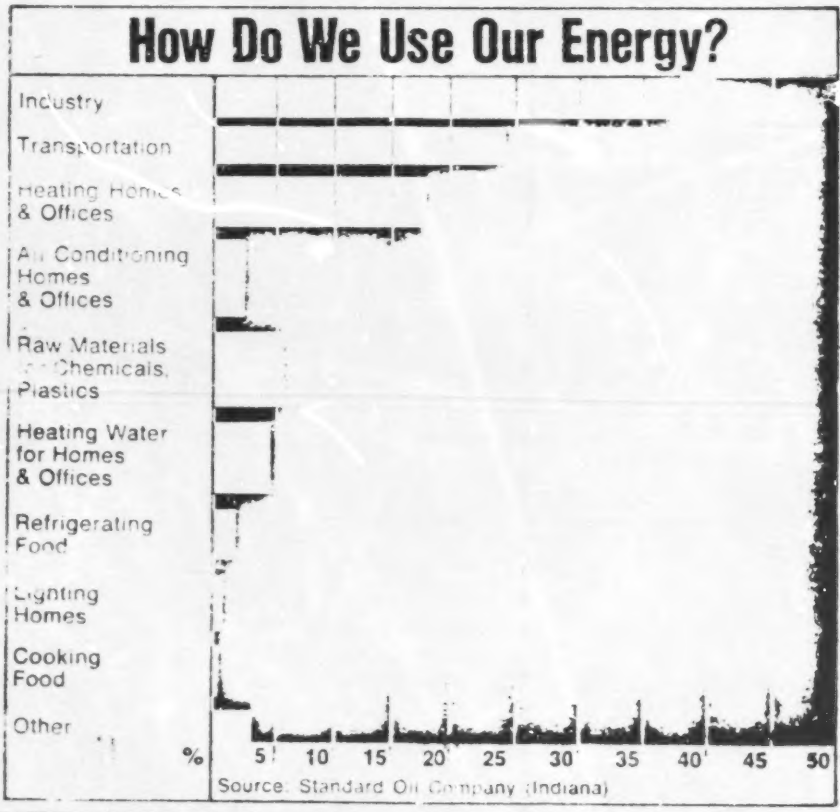
EVERYBODY from the President on down is talking about saving energy, wasting energy, buying and selling energy, and developing energy sources for the future. There's just one problem. Some very basic facts about energy—such as where it comes from and how we use it—tend to get buried under the heaps of energy information. Here, SENIOR pulls some of these most basic energy facts out of the confusion and presents them in bar graphs.

Here are just a few of the questions you'll be able to answer by looking at the graphs:

- What are the three main sources of U.S. energy supplies?
- Is nuclear energy a big source of power in the U.S.?
- What are the three biggest U.S. consumers of energy?
- How much of the oil used by the U.S. is imported?
- What consumes almost 25 percent of the total energy used in the U.S.?
- How much of the total energy used by the U.S. comes from oil?



...There It Goes



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